# The *Brief Evaluation of Receptive Aphasia* test for the detection of language impairment in severely brain-injured patients

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## Background

One of the most common questions regarding post-comatose patients with disorders of consciousness (DoC) is "**Can they understand us**?"

This is even more important as language disorders represent major issues for the assessment of consciousness in patients in a **minimally conscious state** (MCS) or emerging from the MCS (EMCS): **receptive aphasia** might prevent consistent responses to verbal items, leading to an **underestimation of consciousness** in aphasic patients.[1]

Here we aim to develop a **new behavioral tool to assess residual language abilities in DoC patients**, as it was suggested by previous studies.[2]

## Methods

The ***Brief Evaluation of Receptive Aphasia*** (BERA) assesses 3 specific language levels (**phonology, semantic, morphosyntax**) in MCS patients or EMCS patients, as soon as they are **able to visually fixate a target image that is presented next to a distractor**.

1) Multiple assessments in **52 aphasic but conscious** patients, along with the Language Screening Test (LAST): evaluation of intra-/inter-rater reliability, content and concurrent validity;
2) Multimodal assessment of **4 MCS or EMCS patients** comparing their behavioral (i.e., BERA and Coma Recovery Scale-Revised [CRS-R], FDG-PET and MRI (voxel-based morphometry) results: investigation of specific language residual abilities.

## Results

### 1) Multiple assessments in aphasic conscious patients

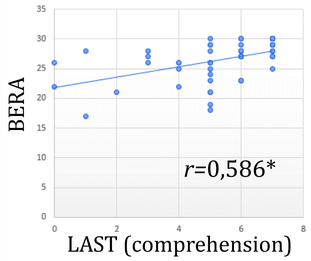
**Content validity**

| | V1 | V2 | V3 |
|---|---|---|---|
| **V2** | r = 0,858*<br>p = 0,003 | / | / |
| **V3** | r = 0,945*<br>p < 0,001 | r = 0,833*<br>p = 0,020 | / |
| **V4** | r = 0,677*<br>p = 0,045 | r = 0,935*<br>p < 0,001 | r = 0,670*<br>p = 0,049 |

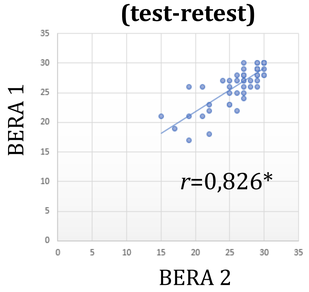
**Inter-rater reliability**

α=0,919*

**Concurrent validity**




**Intra-rater reliability (test-retest)**

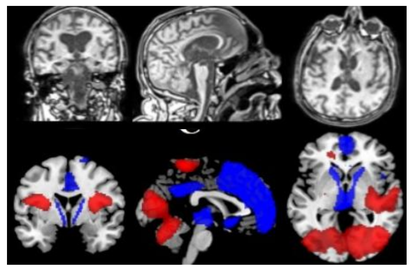



### 2) Multimodal assessment of MCS and EMCS patients

**Patient 1 – MCS+**

**BERA: *21/30***
Phonology: 8/10
Semantic: 8/10
Morphosyntax: *5/10*

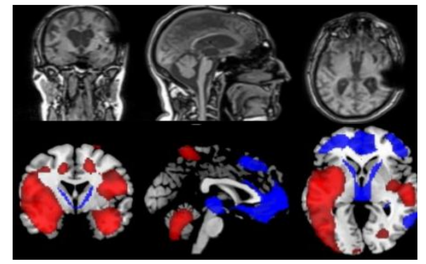
CRS-R: 11/23



**Patient 2 – EMCS**

**BERA: 22/30**
Phonology: 7/10
Semantic: 8/10
Morphosyntax: 7/10

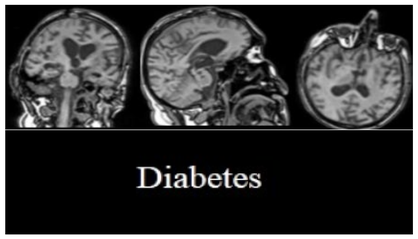
CRS-R: 23/23



**Patient 3 – MCS+**

**BERA: *16/30***
Phonology: 8/10
Semantic: *6/10*
Morphosyntax: *2/10*

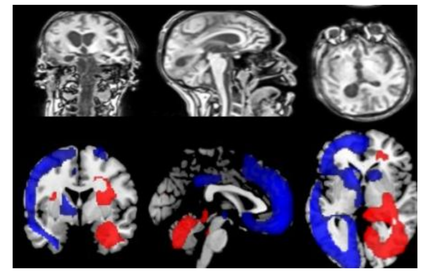
CRS-R: 15/23




**Patient 4 – MCS-**

**BERA: *16/30***
Phonology: 7/10
Semantic: *6/10*
Morphosyntax: *3/10*

CRS-R: 9/23



→ DoC patients' **phonological** sub-scores are **similar** to those of aphasic patients

→ **Semantic** and **morphosyntactic** sub-scores are significantly **lower** than those of aphasic patients

→ **Lower BERA scores** are observed in patients with glucose **hypometabolism in language brain areas**

## Conclusions

The BERA shows **good psychometric properties** in **aphasic conscious** patients.

BERA assessment has been shown to be **feasible** and **efficient in DoC patients**, and complements already existing behavioral assessments.

BERA indicates **language domains** that are **particularly poorly functioning** in DoC patients, and which could be specifically targeted by **rehabilitation**.

[1]Majerus S, Bruno MA, Schnakers C, Giacino JT, Laureys S. The problem of aphasia in the assessment of consciousness in brain-damaged patients. *Prog Brain Res*. 2009;177(C):49-61. doi:10.1016/S0079-6123(09)17705-1.

[2]Schnakers C, Bessou H, Rubi-Fessen I, et al. Impact of Aphasia on Consciousness Assessment: A Cross-Sectional Study. *Neurorehabil Neural Repair*. 2014. doi:10.1177/1545968314528067.

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